Elastic Collision of Equal Masses

Consider a snooker ball of velocity **w** making an elastic off-centred collision with a stationary ball of equal mass. After the collision, let the balls have velocities **u** and **v** respectively.

Momentum conservation: **w** = **u** + **v** (visualize as a vector triangle with **w** longest).

For an elastic collision, kinetic energy is conserved; so

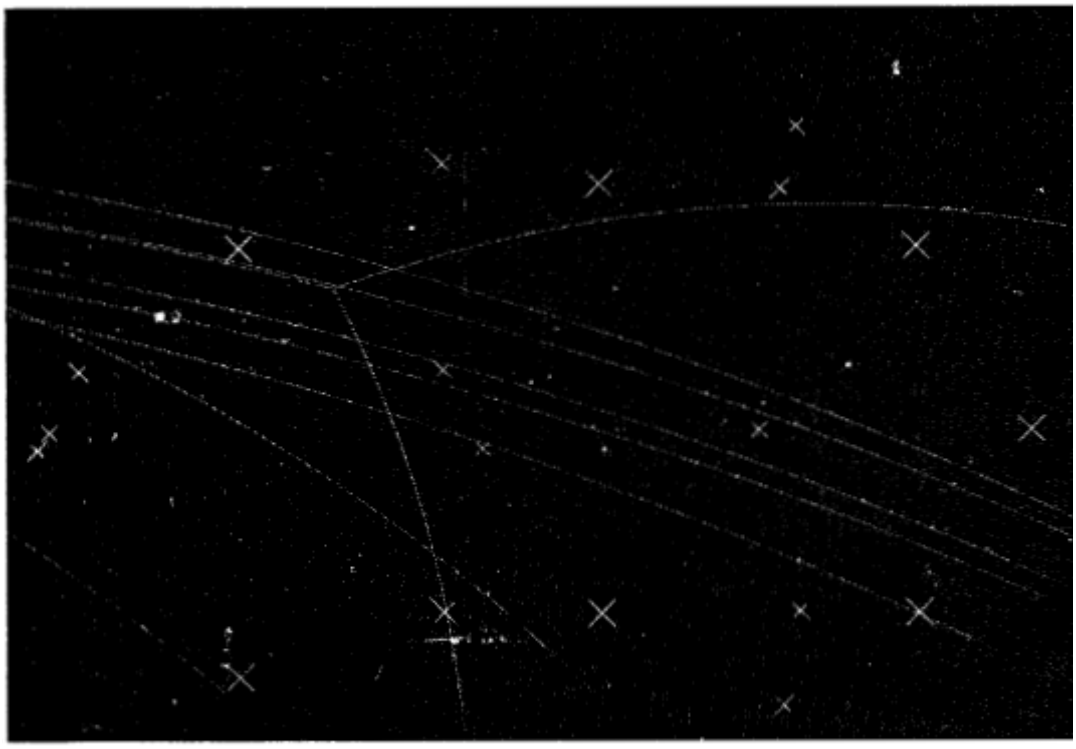
$\frac{1}{2}mw^2 = \frac{1}{2}mu^2 + \frac{1}{2}mv^2 \quad \rightarrow \quad \underline{w^2 = u^2 + v^2}$.

This means that the triangle must be a right-angled triangle with **w** as the hypoteneuse and with **u** and **v** at 90^o to each other.

<u>So when two equal masses collide elastically, they move off perpendicular to each other.</u>

Here is an

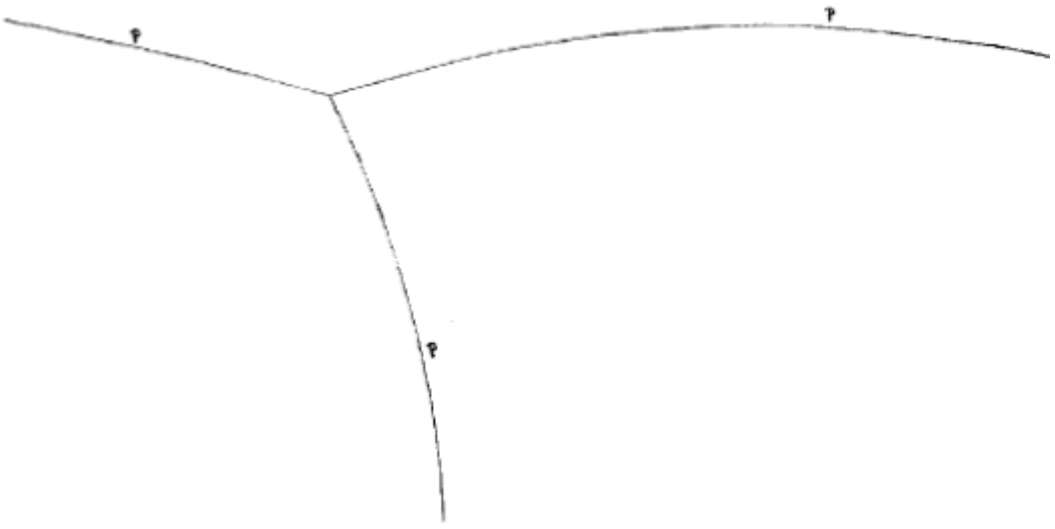
example of an elastic collision of two protons in a bubble chamber.



$p + p \rightarrow p + p$

The projectile proton enters from the left and strikes a (more-or-less) stationary proton. The two outgoing protons emerge from the collision point at right-angles to each other.

(The fact that the angle is not exactly 90^o is due to the fact that the incoming proton is relativistic.)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